

Testimony of Benjamin Z. Houlton, Ph.D.

Ronald P. Lynch Dean of the College of Agriculture & Life Sciences

Cornell University

Hearing Before the U.S. House Committee on Agriculture

“The Role of Climate Research in Supporting Agricultural Resiliency”

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Chairman Scott, Ranking Member Thompson, Members of the Committee, and everyone participating today, thank you for holding this hearing on the critical role of climate research to bolster our food and agriculture systems. I am grateful for the invitation to present on this important topic.

My name is Benjamin Houlton. I am the Ronald P. Lynch Dean of the Cornell University College of Agriculture and Life Sciences, known as Cornell CALS. At Cornell, I hold appointments as a professor of ecology and evolutionary biology and as a professor of global development. My research interests include global ecosystem processes, climate change solutions and agricultural sustainability. I am also founding principal investigator for the Working Lands Innovation Center, directing approximately 100 acres of farmland carbon sequestration projects to improve crop yields and create new financial markets for farmers and ranchers. For nearly two decades I have been working on modeling the global environment and understanding climate change, and for the past decade working explicitly with farmers, ranchers, Indigenous tribes and other partners on solutions for carbon dioxide removal, which is critical to bending the carbon curve and avoiding the most dangerous climate impacts of the future. All of the views expressed in this statement are my own.

At Cornell CALS, we play a critical role in our university’s Land-Grant mission to advance the lives and livelihoods of New York residents through our teaching, research and extension activities. New York – as Committee members Maloney and Jacobs can attest – is

an agriculturally vibrant state with a large and diverse array of fruit, vegetable, dairy and livestock production. Partnering with stakeholders statewide, our faculty are committed to translating research findings into evidence-based support for the wide range of farm sizes and types in our state and bringing findings from the field back to campus labs and classrooms. This two-way knowledge exchange is critical to enriching New York farmers, communities and industries with proven methods and technologies.

I believe our agriculture innovation ecosystem can power the breakthroughs needed to tackle society's most dire threat: a rapidly changing climate, which is severely disrupting U.S. and global food production. We have an urgent need for substantial and sustained investment in science-based solutions and strategies that can address our climate challenges while benefiting the farm communities that produce the foods that nourish us. Agriculture has enormous potential to help cool the planet while feeding it — but only if we accelerate development, testing and implementation of our most promising climate-smart farming innovations.

The threats our world and our farmers face

By accessing the expertise and innovation at Cornell and our partner Land-Grant universities, agriculture is poised to lead our next-generation climate solutions. But we cannot afford any further delay: The time to act is now, while there remains an opportunity to protect our food supply from climate extremes. A few examples highlight the urgency of our challenge:

- A recent analysis found that agricultural productivity over the past 60 years was [21 percent lower](#) than it would have been without climate change — the equivalent of seven years of lost productivity growth. This is a disturbing trend, especially when factoring in the growth of our global population, which could reach 10 billion by 2050. This trend is only expected to worsen, with rising global temperatures projected to significantly reduce crop yields in coming decades.
- The western United States has battled increasing droughts and water shortages in recent decades — a trend that is also forecast to worsen in the coming

decades. A [recent paper](#) suggests that future megadroughts — extended dry periods lasting two decades or more — will last longer, occur more frequently and create more damage than today's conditions. Climate change is expected to accelerate these effects, pushing Earth nearer to an irreversible tipping point.

- At an average of 49.5 degrees Fahrenheit, 2021 was the third-warmest year on record for the Northeast United States, according to the [Northeast Regional Climate Center](#). Since this record-keeping began in 1895, the three warmest years for the Northeast have occurred within the past 25 years. With increasing greenhouse gas concentrations in the atmosphere, these warming trends are expected to continue, along with more powerful extreme weather events.
- In February 2022, the Intergovernmental Panel on Climate Change — a group organized by the United Nations — [issued a report](#) by leading scientists showing major impacts to our world's food systems due to increasing extreme weather events. They signaled a “brief and rapidly closing window to act” to prevent even more crippling consequences.

Every day we see fresh examples of our climate challenges and their dangerous effects. These examples illustrate that climate change is not a faraway or future threat — it is harming lives, businesses and communities right here and right now. And this problem is picking up steam with each passing day, week, month and year. The U.S. along with the rest of the world must act swiftly to address what another recent IPCC report deemed this “code red” crisis for our planet.

Nowhere are the perils more apparent than to our nation's farm and food communities, based predominately in rural areas. High operating costs, volatile commodity prices and stagnating yields are exerting major pressure on farmers, and many are struggling to survive. According to a recent estimate from USDA's Economic Research Service, nearly 90 percent of American farm families require off-farm income to keep their farms afloat.

Further contraction in the agriculture industry and losses in productivity will ultimately threaten our access to safe, affordable food and worsen global hunger, which is already on a menacing rise. Coupled with the fallout of unprecedented crop devastation caused by a [fivefold increase](#) in extreme weather events over the past 50 years – triggering rising pest threats and hotter, wetter weather in the Northeast especially – our farming communities and the sectors they support need solutions, now.

Employing science-based solutions to help agriculture fight back and thrive

To put it directly: The global climate is changing steadily from bad to worse. But because we know why it is changing, we can do something about it. Working together, across industry and academia, with local, state and federal governments, hand in hand with our food and farming communities, I am optimistic we can bend the global warming curve to meet our Paris Agreement obligations while ensuring food security for coming generations.

For years the research community has debated whether the most important place to start is by mitigating greenhouse gas emissions or by removing carbon from the atmosphere. The reality is that we need to do both simultaneously: radically reduce emissions and deploy innovative carbon capture methods. Along with these steps, we need to pursue adaptation strategies to keep our farmers in business by helping them to adjust to the stressors of a changing climate. It is going to take every weapon in our arsenal to stop the dangerous warming of our planet and to safeguard our food systems. We are past the point of either/or thinking: We need solutions that create real-time, local adaptation to weather extremes while slashing emissions and capturing greenhouse gases at scale.

This is a major challenge, yet what makes me hopeful are the many promising technologies and methods that are within our grasp. As climate change intensifies, researchers are working hard to help farmers adapt – developing a host of new climate-smart farming solutions, including new drought-resistant crop varieties, improved management practices to conserve water and digital tools to optimize input efficiency.

Significantly, we are finding that agriculture can be a powerful tool for mitigating climate change, and there is much success on which to build additional efficiency gains. The amount of food produced per acre has increased significantly in the U.S., resulting in fewer greenhouse gas emissions per unit of food. The World Resources Institute estimates that increased efficiencies in U.S. agriculture from 1977-2007 led to a 16% reduction in greenhouse gas emissions per pound of beef produced in the United States. Data indicate that livestock and crop production have increased by about 30% from 1997 to 2017 while increasing their greenhouse gas emissions by only 7%. It is critical to celebrate these advancements and recognize the need to do even more in the U.S. agri-food system.

Building on this success, it is clear that farms don't have to be victims of this challenge – they can take active steps to fight against it if the U.S. makes substantial new investments to support practices to capture and store carbon known as "carbon farming." We can increase carbon sequestration in soils by using natural additives such as biochar, compost and rock dust. Add to this such strategies as rotating crops, planting trees and shrubs alongside crops, and reducing soil turning, and farmers can capture and store atmospheric carbon in soils – benefiting our climate while offering new economic opportunity for rural communities.

With farmland making up approximately half of the United States, if American farmers adopted just some of these carbon farming practices today, they would not only reduce their current greenhouse gas contributions but also could capture and store an amount of carbon equivalent to 15% of annual emissions in the U.S. In the long term, carbon farming can even increase resistance to drought, cut fertilizer costs and boost crop yield.

Additional promising new techniques and technologies are under development to broaden farmers' ability to adapt to and combat climate change through reductions in methane, nitrous oxide and other greenhouse gases.

In one exciting example of this work, the Cornell CALS Department of Animal Science, with support from New York state, will install four climate-controlled respiration chambers on campus this year. The first of their kind in the United States, they will support

experiments to reduce climate-warming methane emissions from cattle and other domestic animals, while examining how to optimize animal health, nutrition and production. This innovative project will provide New York dairy farmers with verified, responsible solutions for net-zero operations, ensuring that the technology delivers on its promise before being widely adopted in the marketplace. New science-based technologies to address enteric fermentation coupled with existing technologies, such as anaerobic digester systems and precision manure application strategies, have the potential to significantly reduce methane in the near future, a necessary step to help immediately reduce global warming.

Beyond the existing technologies and approaches, continued pioneering science in boosted photosynthesis can produce higher crop yields while sequestering carbon through new plant varietals. When combined with synthetic biology, artificial intelligence and machine learning, plant geneticists are finding new opportunities to increase photosynthesis and create more resilient seeds for farmers, which will be needed as climate impacts continue to mount.

Equally critical, we must increase financial incentives to support farmers' exploration of opportunities to commoditize carbon and other greenhouse gas emissions and adapt to weather extremes. Not enough farmers in America today can afford to embrace these practices and make a measurable impact. Committing to new practices presents financial risks for farmers already stressed by economic hardship and weather extremes.

As we peruse these strategies, we also need to ensure that we are developing an inclusive culture that delivers on the promise of a more just and equitable farm and food system. The 2017 New York state agriculture census [cites that only 1.3%](#) of New York farmers and producers identify as people of color. The lack of money or margins to innovate with climate solutions is felt by farmers of color, many of whom have been historically excluded and tend to own smallholder farms, thus lacking the land and the financial capital to take advantage of these opportunities. Strategies employed by policymakers and granting agencies to target resource allocation for historically underrepresented farmers will be vital for a more just transition to net-zero agriculture.

Through public-private partnerships involving academia, business, government and civic organizations, we can advance the innovative research and scalable technologies needed to achieve this vision. And we can do so in ways that ensure farmers and foresters receive not just public praise for their efforts to sequester carbon, but also support that makes sound economic sense, provides equity and boosts overall farm profitability.

A time for action and investment in our future

As we pursue climate-smart agricultural practices to sustain our world, the Land-Grant system provides a critical research and development test bed to pilot and refine these approaches without placing another financial burden upon our farmers. For all of us to enjoy eating locally produced foods in the decades to come, we need to provide scientists with sufficient and sustained research funding and resources to ensure our crop varieties are climate-adapted in the future, and that we continue to innovate with new tools to help farmers increase production in the face of rapid climate extremities.

As the Committee works to develop new programs and policies to address climate change through research, I'd like to point to two exemplary USDA programs that are models of interagency cooperation and partnership between Land-Grant universities, farmers and communities. First, USDA's Climate Hubs allow collaboration across agencies and with external partnerships to develop and deliver science-based, region-specific decision making, information, and research-informed climate change response. The impacts of climate change span countless scientific disciplines and government programs, so continuing to fund models like this that support holistic research solutions across expertise and federal agencies is key. Another exciting model, the USDA's new Partnerships for Climate-Smart Commodities program, offers grant funding to a wide variety of public and private entities to incentivize market opportunities for commodities that develop and adopt climate-smart practices.

Cooperative Extension programs, which have worked through the Land-Grant system in collaboration with farmers, producers and community groups for more than a century, will be essential to translating scientific research and developing new commercial opportunities from our labs out to the land. The relationships that Cooperative Extension has cultivated among farmers and in communities serve as necessary partners for university-based scientists – they enable us to understand the real-world needs of our stakeholders and assist in deployment of new opportunities, whether they be anaerobic digesters for dairy, new crop varietals for growers, new management practices, or carbon farming through the soil. Even as it is critical that Land-Grant universities continue to leverage Cooperative Extension, it is just as critical that Congress continue to bolster support for these programs. Otherwise, it will be more difficult to succeed at the scale and with the urgency that is necessary to avoid the most dangerous climate outcomes, preserve food security, and revitalize the farm sector and rural communities.

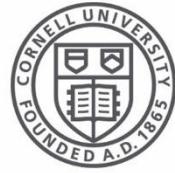
Though helpful, these programs alone are not enough; agricultural research is key to fighting climate change and protecting global food supplies, but pathways to innovation are under threat.

The U.S. has fallen behind competitors China and Brazil in public support for agricultural research, according to a [recent report](#) commissioned by Farm Journal Foundation and the American Farm Bureau Federation. U.S. public funding for agricultural research has declined in real dollars since 2003, while investments in other forms of domestic research have risen.

This lack of support means that across the U.S., many potentially groundbreaking studies are significantly underfunded or even unfunded – which can delay or stifle important discoveries. Many universities are in desperate need of infrastructure investments to upgrade laboratories and other facilities for the 21st century. According to the Association of Public and Land Grant Universities, 69% of the buildings and facilities at U.S. schools of agriculture are at the [end of their useful life](#).

Scientific research takes years to refine and develop before new discoveries are ready for the market. Therefore, it is important to prioritize agricultural research funding today, to ensure that our nation's crop and livestock producers can stay one step ahead of the climate crisis. It is disappointing that the U.S. – which is one of the largest and wealthiest consumers and producers of food on the planet – is not leading the world in research and development of climate-smart solutions for agriculture.

Just as important as supporting USDA-funded agriculture research, it is equally critical that Congress support cross-agency research and development programs. We should be encouraging more linkages between the National Science Foundation and its emphasis on translation; the Department of Energy and its focus on synthetic biology, carbon capture and renewable energy; and the National Institutes of Health and its focus on public health; among others. Like-minded federal agency programs could be coordinated with the USDA to develop future-forward “moonshots” for agriculture with a focus on the development of new carbon-smart approaches that create healthier and more equitable food systems as well as energy deployment that empowers rural communities and historically marginalized and disadvantaged people in the United States. Cross-agency programs could spur new innovations and scientific discoveries across disciplines, from computer science to plant breeding, engineering to public health, landscape development and soil science to economics and finance. Just like with the Human Genome Project, we need a concentrated effort in agriculture and food of the future if we are to succeed in reducing emissions and capturing carbon from the air. Doing so will help ensure that the best and brightest scientific ideas make it from our university laboratories into farmers' hands – turning the agricultural industry into a climate change success story and creating a more food-secure future for all of us.



Benjamin Z. Houlton

Benjamin Z. Houlton is the Ronald P. Lynch Dean of the College of Agriculture and Life Sciences and a Cornell University professor of Ecology and Evolutionary Biology as well as Global Development. Houlton began his term on Oct. 1, 2020, as the 12th Cornell CALS dean. He serves as co-chair of Cornell's 2030 Project: A Climate Initiative, mobilizing practical solutions that mitigate the impacts of climate change.

As a premier institution of scientific learning and discovery, Cornell CALS is a world leader in tackling the complex challenges of our time with a culture of interdisciplinary understanding and collaboration. It is home to Cornell University's second largest total college population, with 3,600 undergraduate students, 1,020 affiliated graduate students, 350 faculty and 1,000 staff. The college offers 20+ majors and 40+ minors, managed by 16 academic departments and two schools. In fiscal year 2021, CALS led Cornell's Ithaca campus with a total of \$238 million in research expenditures.

Ben has published more than 130 works including peer-reviewed scientific articles, book chapters and published abstracts. An accomplished international scientist, his research interests include global ecosystem processes, climate change solutions, and agricultural sustainability. Ben's work has been published in leading scientific journals such as *Nature*, *Science*, *Nature Climate Change*, and the *Proceedings of the National Academy of Sciences* and has been covered by news media including the *New York Times*, *Scientific American*, *NPR*, *The Christian Science Monitor*, *Discovery News*, *MSNBC/Tonight* and the *BBC*. As part of his mission to connect scientific discovery with the public, he is also a frequent guest on regional and national news programs.

Ben is co-founder of The N3gative Company, which is empowering farmers and land managers with the tools to create, verify, and exchange permanent carbon dioxide removal in soil. The company's approach will scale up permanent carbon dioxide removal in soils around the world to remove millions to billions of tons of carbon dioxide each year while also improving agricultural productivity. He is also founding principal investigator for the Working Lands Innovation Center, where he directs approximately 100 acres of farmland carbon sequestration projects to improve crop yields and create new financial markets for farmers and ranchers. He is a member Boyce Thompson Institute's Board of Directors and editor of *Global Biogeochemical Cycles* published by the American Geophysical Union, the world's largest society promoting geophysical endeavors of Earth and space scientists. As dean, he also shares responsibility for leadership of Cornell Cooperative Extension throughout New York state with the College of Human Ecology.

Benjamin Z. Houlton, Ph.D.
The Ronald P. Lynch Dean

260 Roberts Hall
Ithaca, NY 14853-5905
cals.cornell.edu

bzhoulton@cornell.edu
Phone: 607.255.2241
Fax: 607.255.3803

Prior to joining Cornell, Ben served on the UC Davis faculty since 2007, teaching global environmental studies with a co-appointment in the UC Agriculture Experiment Station. He also led their John Muir Institute of the Environment, bringing together more than 300 faculty affiliates, 350 postdoctoral researchers, staff, and students from across the university with the goal of devising innovative solutions to the environmental sustainability challenges of the 21st century. As part of the institute, he led the new OneClimate “Big Idea,” an inter-disciplinary, team-based approach to reduce greenhouse gas emissions and help people, ecosystems, and agriculture adapt to an uncertain climate future. Ben served as faculty director of two diversity, equity and inclusion programs at UC Davis – EnvironMentors and SEEDS – and supported the launch of GOALS (Girls’ Outdoor Adventure in Leadership and Science) at the Muir Institute. He also worked with California tribes to empower the application of indigenous knowledge in agricultural and environmental sustainability. He has served as a scientific advisor to a Rockefeller Foundation and World Wildlife Fund project on sustainable agriculture, human nutrition, and climate solutions.

Ben received his B.S. from the University of Wisconsin – Stevens Point in Water Chemistry, an M.S. from Syracuse University in Environmental Engineering Science, and a Ph.D. from Princeton University in Ecology and Evolutionary Biology. He spent two years working as a postdoctoral scholar at Stanford University and the Carnegie Institution for Science at Stanford before joining the UC Davis faculty. Ben is the recipient of the Gene E. Likens Award from the Ecological Society of America, the Andrew W. Mellon Foundation Young Investigator Award, and the NSF-CAREER award.

Ben grew up in Wisconsin and Minnesota, solidifying his dedication to the environment at a young age while camping with his family throughout the Midwest and spending time on his great aunt and uncle’s dairy farm. His family legacy in agriculture spans the dairy, poultry, and grain commodities, and still includes one remaining family dairy farm in Kansas. He can often be found fly fishing, running, traveling internationally, and coaching his kids’ soccer teams in his spare time.

Introductory talking points (to be used when verbally introducing Dean Houlton):

- Ben Houlton (HOLE-ton) is the Ronald P. Lynch Dean of the College of Agriculture and Life Sciences, a position he has held since Oct. 1, 2020. He is a professor in the college's departments of Ecology and Evolutionary Biology as well as Global Development. He is also co-chair of Cornell's "2030 Project: A Climate Initiative."
- He has a Ph.D. from Princeton University and his family spans generations of Midwestern dairy and poultry farmers.
- An accomplished environmental scientist, he is an active researcher and advises diverse students and postdocs in agricultural and environmental science, with an emphasis on climate solutions and global biogeochemical cycles.
- Dean Houlton is also the co-founder of The N3gative Company, which is empowering farmers and land managers with the tools to create, verify, and exchange permanent carbon dioxide removal in soil.
- Ben has published more than 130 works including peer-reviewed scientific articles, book chapters and published abstracts.
- As part of his mission to connect scientific discovery with the public, he is also a frequent guest on regional and national news programs.
- Please join me in welcoming Dean Ben Houlton.

Truth in Testimony Disclosure Form

In accordance with Rule XI, clause 2(g)(5)* of the *Rules of the House of Representatives*, witnesses are asked to disclose the following information. Please complete this form electronically by filling in the provided blanks.

Committee: Agriculture

Subcommittee: _____

Hearing Date: 06/15/2022

Hearing Title :

"The Role of Climate Research in Supporting Agricultural Resiliency"

Witness Name: Benjamin Z. Houlton

Position/Title: The Ronald P. Lynch Dean of Cornell University's College of Agriculture and Life Sciences

Witness Type: Governmental Non-governmental

Are you representing yourself or an organization? Self Organization

If you are representing an organization, please list what entity or entities you are representing:

Cornell University's College of Agriculture and Life Sciences

FOR WITNESSES APPEARING IN A NON-GOVERNMENTAL CAPACITY

Please complete the following fields. If necessary, attach additional sheet(s) to provide more information.

Are you a fiduciary—including, but not limited to, a director, officer, advisor, or resident agent—of any organization or entity that has an interest in the subject matter of the hearing? If so, please list the name of the organization(s) or entities.

Scientific Founder and Scientific Advisor of The N3gative Company

Please list any federal grants or contracts (including subgrants or subcontracts) related to the hearing's subject matter that you, the organization(s) you represent, or entities for which you serve as a fiduciary have received in the past thirty-six months from the date of the hearing. Include the source and amount of each grant or contract.

None to report

Please list any contracts, grants, or payments originating with a foreign government and related to the hearing's subject that you, the organization(s) you represent, or entities for which you serve as a fiduciary have received in the past thirty-six months from the date of the hearing. Include the amount and country of origin of each contract or payment.

None to report

Please complete the following fields. If necessary, attach additional sheet(s) to provide more information.

- I have attached a written statement of proposed testimony.
- I have attached my curriculum vitae or biography.

*Rule XI, clause 2(g)(5), of the U.S. House of Representatives provides:

(5)(A) Each committee shall, to the greatest extent practicable, require witnesses who appear before it to submit in advance written statements of proposed testimony and to limit their initial presentations to the committee to brief summaries thereof.

(B) In the case of a witness appearing in a non-governmental capacity, a written statement of proposed testimony shall include—
(i) a curriculum vitae; (ii) a disclosure of any Federal grants or contracts, or contracts, grants, or payments originating with a foreign government, received during the past 36 months by the witness or by an entity represented by the witness and related to the subject matter of the hearing; and (iii) a disclosure of whether the witness is a fiduciary (including, but not limited to, a director, officer, advisor, or resident agent) of any organization or entity that has an interest in the subject matter of the hearing.

(C) The disclosure referred to in subdivision (B)(iii) shall include— (i) the amount and source of each Federal grant (or subgrant thereof) or contract (or subcontract thereof) related to the subject matter of the hearing; and (ii) the amount and country of origin of any payment or contract related to the subject matter of the hearing originating with a foreign government.

(D) Such statements, with appropriate redactions to protect the privacy or security of the witness, shall be made publicly available in electronic form 24 hours before the witness appears to the extent practicable, but not later than one day after the witness appears.